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PATENT

43247

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Hajime MATSUMOTO et al.

Serial No.: 10/003,044

Filed: December 6, 2001

For: PRODUCTION PROCESS FOR
HYDROXYLALKYL (METH)ACRYLATE

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: Group Art Unit: 1621
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: Examiner: K. Puttlitz
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RESPONSE AFTER FINAL REJECTION UNDER 37 C.F.R. § 1.116

Commissioner for Patents
P.O. Box 1450
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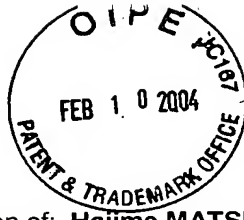
Sir:

In response to the December 10, 2003 Office Action.

In the Action, claims 1, 3 and 5-7 are rejected. In view of the following comments, reconsideration and allowance are requested.

Rejection Under 35 U.S.C. § 103(a)

Claims 1, 3 and 5-7 are rejected as being obvious under 35 U.S.C. § 103(a) over U.S. Patent No. 6,414,182 to Shingai et al. Shingai et al. was cited in the previous rejection for disclosing a reaction between a carboxylic acid and an alkylene oxide to produce a hydroxyalkyl ester. Contrary to the suggestion in the Action, Shingai et al. does not disclose or suggest the step of distilling the resulting reaction liquid at a pressure of 1 to 40 hPa to recover the unreacted (meth)acrylic acid and thereafter recycling the recovered unreacted (meth)acrylic acid as a raw material for the reaction. As discussed below, Shingai et al.



AF/1621

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Examiner: K. Puttitz

For: **PRODUCTION PROCESS FOR HYDROXYLALKYL (METH)ACRYLATE**

COMMISSIONER FOR PATENTS

P.O. Box 1450

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Transmitted herewith is a Response in the above-identified application:

☐ Applicant claims small entity status. See 37 CFR 1.27.

☒ No additional fee is required.

The fee has been calculated as shown below:

	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NO. PREVIOUSLY PAID FOR	PRESENT EXTRA	SMALL ENTITY		OTHER THAN A SMALL ENTITY	
				RATE	ADDIT. FEE	RATE	ADDIT. FEE
TOTAL	6	- 20 =	0	x 9 =	\$	x 18 =	\$
INDEP	1	- 3 =	0	x 43 =	\$	x 86 =	\$
<input type="checkbox"/> FIRST PRESENTATION OF MULT. DEP. CLAIM				+ 145 =	\$	+ 290 =	\$
If the difference in Col. 1 is less than zero, enter "0" in Col. 2				TOTAL	\$	TOTAL	\$

☐ Applicant(s) petition(s) for an extension of _____ month(s) to respond and submits herewith the fee of \$_____.

☐ Please charge my Deposit Account No. 18-2220 in the amount of \$_____. A duplicate copy of this sheet is attached.

☐ A check in the amount of \$_____ is attached.

☒ The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. 18-2220. A duplicate copy of this sheet is attached.

☒ Any additional excess claim fees under 37 C.F.R. § 1.16.

☒ Any additional patent application processing fees under 37 C.F.R. § 1.17.

Dated: February 18, 2004

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discloses distillation as one method of removing impurities, but does not disclose recovering unreacted (meth)acrylic acid by distillation.

The Action bases the rejection on the general disclosure in Shingai et al. of distilling to remove “impurities”. This broad and general disclosure of distilling a reaction product does not fairly or reasonably suggest the claimed process of distilling the reaction mixture to recover (meth)acrylic acid. Contrary to the suggestion in the Action, the cited passages in Shingai et al. do not suggest distilling to recover (meth)acrylic acid and thereafter recycling the recovered acrylic acid.

Initially, it is noted that claim 1 specifically recites distilling the reaction mixture at a pressure of 1-40 hPa. Shingai et al. does not disclose the claimed pressure and the Action appears to disregard this limitation.

Shingai et al. makes a clear distinction between 1) the step of recovering unreacted residue, and 2) the purification step to remove impurities. The Action appears to suggest that because Shingai et al. discloses distillation generally, it would be obvious to recover the unreacted (meth)acrylic acid by distillation. Shingai et al. clearly disclose the step of recovering the unreacted residue such as the (meth)acrylic acid as a first step. The details of this first recovery step are not disclosed in Shingai et al. Thus, in the absence of any specific teaching in Shingai et al., one skilled in the art would interpret this as a conventional separation step such as by stripping or absorption. The Action has not disputed the absence of any specific teaching in Shingai et al. of the recovery of the reactants and has provided no basis for the contention that the recovery step of Shingai et al. is anything other than a conventional process.

The passages relied on in the Action relating to the purification step are carried out after the reactants have been recovered in the previous step. The purification step, which can

be by distillation, is clearly a second step that is separate and distinct from the recovery step. It is clear that the purification step is carried out subsequent to the recovery of the reactants. One skilled in the art would not consider it obvious to distill the reaction mixture to recover the reactants in view of the distinction between the steps by Shingai et al. Since Shingai et al. clearly provides a first separation step to recover the unreacted residue, the teaching or suggestion to one skilled in the art is that the subsequent step is not capable of recovering the (meth)acrylic acid. If it was obvious to one skilled in the art that (meth)acrylic acid could be recovered by distillation, Shingai et al. would not provide a first separation step followed by a second purification step.

The Action suggests that it would be obvious to recover the reactants by distillation even though Shingai et al. does not disclose the step. However, the distillation step of Shingai et al. is to remove the high boiling point impurities after the low boiling point reactant has been removed. Therefore, Shingai et al. does not disclose or suggest the claimed invention.

Moreover, it is clear that Shingai et al. and one skilled in the art does not recognize that the reactants can be recovered by distillation. Shingai et al. discloses the purification by distillation after the recovery of the reactant which clearly shows that Shingai et al. does not recognize that the reactants can be recovered by distillation. Shingai et al. would not teach a separate recovery step if it was obvious to one skilled in the art that the reactants can be recovered by the same process that is used to remove the impurities.

As previously discussed, the present invention is directed to a process for producing a hydroxyalkyl (meth)acrylate where the unreacted (meth)acrylic acid is recovered by distillation. The reaction of a carboxylic acid and an alkylene oxide produces a hydroxyalkyl ester in a yield that is often less than 100%. Page 2, lines 14-18 of the present specification

discloses that (meth)acrylic acid has a strong affinity for the hydroxyalkyl (meth)acrylate and has a low relative volatility. Furthermore, the (meth)acrylic acid is easily polymerizable alone or in a mixed solution. As disclosed on page 11, lines 1-12 of the present specification, the prior processes for the separation, recovery and recycling of unreacted (meth)acrylic acid are difficult to carry out.

The present invention recited in claim 1 is directed to the production process for producing a hydroxyalkyl (meth)acrylate and includes the step of distilling the resulting reaction liquid under a pressure of 1 to 40 hPa to recover the unreacted (meth)acrylic acid and thereafter recycling the recovered unreacted (meth)acrylic acid as a raw material. The art of record does not disclose or suggest the claimed process. The Action mischaracterizes Applicants' previous arguments. Applicants do not dispute that Shingai et al. discloses recycling of reactants generally. However, Shingai et al. does not disclose or suggest recycling unreacted (meth)acrylic acid that has been recovered by a distillation step.

The Action refers to column 2, lines 30-40 of Shingai et al. as allegedly disclosing a distillation step for the removal of raw starting materials. As disclosed in column 2, lines 36-39, the reaction liquid is led to a conventional step to remove the unreacted residues of raw material. Only after the unreacted residues of raw materials have been removed, is the liquid purified by distillation in a "subsequent final step" (emphasis added) to obtain the resulting hydroxyalkyl ester. Thus, this passage specifically discloses removing the unreacted components such as the (meth)acrylic acid prior to the purification by distillation. There is no suggestion of distilling the reaction liquid to recover the unreacted (meth)acrylic acid in the distillation step. Furthermore, the examples of Shingai et al. also do not describe a method of removing the unreacted raw materials. Accordingly, Shingai et al. does not

disclose or suggest removing unreacted raw materials from the resulting reaction liquid by distillation.

Column 12, lines 27-52 of Shingai et al. disclose generally recycling of unreacted materials to the reactor by separating a portion of the reaction liquid and recycling directly to the reactors as shown in Figure 5. The recycled portion is withdrawn directly from the outlet stream from the reactor as shown in Figure 5 and directed to the reactors 10 and 11 through lines 18 and 19, respectively. The passage also discloses recycling “the residue as produced by removing the hydroxyalkyl ester... from the reaction liquid.” Thus, it is residue after the final reaction product is removed that is recycled. There is no disclosure or suggestion of separating or recovering the unreacted (meth)acrylic acid as in the claimed invention. This passage also does not disclose or suggest distilling the resulting reaction liquid to recover the unreacted (meth)acrylic acid from the reaction liquid and then recycling the recovered (meth)acrylic acid as in the claimed invention. Shingai et al. discloses purifying the crude hydroxyalkyl ester as a final step after the above-noted recycling of a portion of the reaction liquid.

Claim 1 and the claims depending therefrom are not obvious to one of ordinary skill in the art in view of Shingai et al. There is no suggestion in the art to distill the reaction liquid to recover unreacted (meth)acrylic acid and thereafter recycling the recovered (meth)acrylic acid as in claim 1. Furthermore, the Action provides no motivation or incentive to one of ordinary skill in the art to modify the process of Shingai et al. to include the claimed recovery of the (meth)acrylic acid by distillation and the recycling step. The cited art provides no suggestion of distilling the reaction liquid at a pressure of 1 to 40 hPa to recover the (meth)acrylic acid as claimed. The claimed operating pressure is important to the distillation, condensing and recovering of the (meth)acrylic acid as disclosed on page 11, line

13 to page 12, line 2 of the specification. The importance of the operating pressure is evident from Comparative Example 1 and Comparative Example 2 of the specification. The distillation of the reaction mixture in Comparative Example 1 was at a pressure above the range of claim 1 which forms a polymerized product which can cause clogging of the column. Comparative Example 2 which is at a pressure below the claimed pressure results in an uncondensed vapor in the top of the condenser, thereby making it difficult to recover and condense the vapor. This demonstrates that the pressure has a significant affect on the distillation that is not obvious in view of Shingai et al.

Claim 2 depends from claim 1 to recite the step of recovering the unreacted alkylene oxide together with the unreacted (meth)acrylic acid in the distillation step, and thereafter recycling the alkylene oxide and unreacted (meth)acrylic acid. Claim 3 depends from claim 1 to recite the first step of separating unreacted alkylene oxide from the reaction liquid and thereafter recovering the unreacted (meth)acrylic acid by the distillation step. Shingai et al. does not disclose or suggest these process steps.

As note on page 11, lines 1-5 of the present specification, the conventional separation of alkylene oxide involves separating by stripping and recovering by absorbing solvents. Shingai et al. discloses only the conventional processes for recovering the unreacted reactants. Shingai et al. clearly fails to disclose or suggest recovering unreacted alkylene oxide together with the unreacted (meth)acrylic acid by distillation and then recycling the unreacted alkylene oxide and (meth)acrylic acid as in claim 2. Shingai et al. provides no motivation or incentive to subject the reaction liquid to distillation to recover the alkylene oxide and (meth)acrylic acid simultaneously in the distillation step as presently claimed.

Shingai et al. further fails to disclose or suggest a first step of separating and recovering the unreacted alkylene oxide from the reaction liquid and thereafter distilling the

reaction liquid to recover the unreacted (meth)acrylic acid. Accordingly, claim 3 is not obvious to one of ordinary skill in the art in view of Shingai et al.

Shingai et al. also fails to disclose distilling the reaction liquid with a plate column and/or packed column as in claim 5, distilling the reaction liquid in the presence of polymerization inhibitors, or distilling the reaction liquid where the reaction liquid has a (meth)acrylic acid concentration of 0.1 to 20 weight % as in claim 7. Shingai et al. discloses generally the use of conventional polymerization inhibitors during the reaction. There is no suggestion of distilling the resulting reaction liquid in the presence of polymerization inhibitors to recover unreacted (meth)acrylic acid). Accordingly, claims 5-7 are not obvious over Shingai et al.

In view of the above comments and these amendments, claims 1-3 and 5-7 are allowable over the art of record. Accordingly, reconsideration and allowance are requested.

Respectfully submitted,



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